The Analysis of Virtual Voice Based on The Network Teaching Platform Data

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Abstract

The feedback of the students has always been the hot issue of the scholars' study. The development of information technology not only affects the conduct of teaching, but also impacts the management of university. This analysis evaluate continuing education students' network learning through data mining, visualization analysis, Hierarchical Clustering method, etc. The study analyze the overall situation access the network platform module, training time distribution, time preference, students' learning, the classification of the students and the interaction with teachers and students of students, and to explore the characteristics of online learning behavior in order to dig out the 'virtual voice'. The results showed that content options module is the main place where teachers interact with students; online learning start-stop schedule exhibited greater flexibility. And the students participating in continuing education prefer to study time from Monday to Thursday night. There are different activities and popular modules among student groups. This paper argues that managers and teachers can adjust the teaching plan, method and strategy according to the characteristics of continuing education students' learning behavior, students' activity and popular module, so as to improve the educational management and teaching level of teachers in colleges and universities.

Practitioner Notes

What is already known about this topic:

- the feedback of students at schools and universities, as a key tool to improve teaching and learning practices.
- The feedback of the students is mostly from the traditional approaches such as the questionnaire and group discussion.
- Nowadays, students can use any device network learning at anytime, anywhere.
- It is helpful to improve the teaching quality to analyze the online interaction between teachers and students.

What this paper adds:

- Explores how to use information technology to obtain Student's feedback.
- Demonstrates how to apply Knowledge Discover in Database (KDD) to get Student's feedback.
- Analysis the network data is how to reflect Student's feedback.

Implications for practice and/or policy:

- It can save cost and shorten the analysis time to obtain Student's feedback by analysis of big data.
- It can get a more comprehensive understanding to Student's feedback, such as the students' personal information, learning behavior and learning effect, etc.
- Comprehensive Student's feedback can improve the teaching mode and the management of student.
- Keep up with the trend of the times development and innovate a new way of Student's feedback.

Introduction

In the 90s, some scholars began to pay close attention to the students' views and opinions and found that their views and opinions contributed a lot on the reform of the teaching and school management. 'Student's feedback' movement has slowly begun to spread internationally in education ever since.

With the arrival of the popularization of higher education [1] especially the development of adult education, teaching and management of higher education have met certain challenges [2-4]. College students as a part of the national higher education system, their behavior will affect the development of higher education. Some schools listen to the students' voices constantly to advance the reform of school management and teaching [5-7]. Most organizations will take the questionnaire [8], group discussion and job

satisfaction [9,10] to get the students' feedback. In addition, the UK NSS intended to provide effective feedback in the process of student education, including students of institutions of higher education and continuing education, which also led to many university administrators and teachers seeking to solve the diverse needs of students [11]. Bovill et al. (2010) [12] also believe that teachers should not only consult students but also allow students to fully participate in the session curriculum, instructional design and development, similar to the national agenda [14].

With the development of information technology, students can learn through internet with any network equipment at any time, any place. Students' learning has been shifting from the classroom, the face-to-face interaction into network platform [15]. Therefore, the scholars discussed 'virtual voice' (virtual voice, namely learning behavior characteristics in the network, hereinafter referred to as 'VV'). 'VV' mainly refers to that students published curriculum reform and management in the virtual community [16]. Virtual community is a network sharing platform for teacher-student interaction and autonomous learning. It explores the direction of curriculum reform through the characteristics of web-based learning behavior. Eugene Borokhovski (2012) [17] studied the situational interaction and designing interaction. The situational interaction method includes the necessary conditions for intra-students interaction. The interaction environment is not deliberately created, on the contrary, the designed interaction method intended to improve students' learning collaborative. Through comparing the two methods, the results showed that the designed interaction was more effective. At present, more institutions will be using more technology tools (remote access) to strengthen the learning support services and facilities [18,19]. Websites and online platforms as one of the main sources of educational content, trends in e-learning and distance simulations [20]. E-learn in an online environment can also shape adult learners' perceptions on how they understand and in regard to the generational cohort [21]. There is a core set of online learning experiences that are central to other experiences and these are shared among the majority of people who learn online [22].

Adult education is a special form of higher education. It is not only an important way to promote the development of continuing education, but also an important way to advance the process of lifelong education. Adult education has become an essential element of sustainable education, quality education for lifelong childbearing has become a driving factor for the development of living habits and healthy aging, and social and psychological risk factors related to the evolution of COVID-19 [18] And, it is an important part of China's higher education. The development of adult higher education in China began in the period of Westernization Movement [20]. "Internet +" provides a new development opportunity for adult education, enabling adult education to realize

informatization development on the basis of exerting its own unique advantages and overcoming the shortage of resources and teachers [19]. With the development of information technology, adult general higher education has also entered the era of Informa ionization and digitization. Online education has emerged, which is based on the popularity of Internet technology and media. A new teaching model makes the educated group wider and the way of education more flexible and diverse. In 2021, the number of Web-based Undergraduates in China's higher education reached 8.73 million. It is the development of online education that has enabled China's adult higher education to develop as it should. With the development of online education, Chinese scholars will study the feedback of students on the Internet. Online tutors can formulate online education programs suitable for the actual situation of Chinese higher education students based on feedback information, which has become an important research issue in the construction of Chinese adult higher education information.

Therefore, this article mainly studied the network platform of education through data mining, described the behavior characteristics of students' online learning in order to dig out the "virtual Voice", as an important information, finally will improve teaching and learning practice.

Context

This paper selects the students in continuing education class of a university as the research object, which is the Institute of Education tries to rely on Blackboard platform for auxiliary teaching class. This research mainly explored the behavioral characteristics of adult students through data mining method in order to find new solutions for implementing online learning in Adult Education College of a university, at the same time, it can improve online teaching for teachers. This study selects the continuing education class as the research object, mainly because the continuing education students are difficult to get the sufficient guarantee in the study time. The work time, family and personal factors often conflict with the study time. It prevents students from having classes during weekends. Therefore, it is positive significance for the extensive application of network teaching in continuing education to carry out auxiliary teaching and autonomous learning and monitor it in the students' continuing education. Moreover, most of the students in continuing education already have a job, and their learning purpose is so strong that most of them study with problem-solving ideas. Therefore, in choosing courses, they should not only be in line with strong interests. Also, in line with the characteristics of great practicality. Combined with adult learning characteristics, this example selects "Computer Application Foundation" Course in the Blackboard platform as samples. The course of face-to-face teaching time was in the weekend. Its teaching methods mainly were face-to-face teaching mode combining with network auxiliary teaching. Main courses provided students not only with knowledge of the theory of the electronic version of the computer, video, and computer practical operation and basic computer-related learning resources,

but also with group discussion, wiki editing and posting. There were 49 students (who are from Adult Education College of a university) and a teacher (who provide teaching and counseling services) participating in this course. This course began from October 10 to November 11 in 2017. This paper explored the learning activity distribution characteristics of online education, learning time distribution characteristics and interaction characteristics of teachers and students through the log and interactive data in the Blackboard platform to find "Virtual Voice" (behavior characteristics on network learning) in order to reflect the progress and status of network education. Thus, it would provide valuable information for the improvement of teaching methods both on and off line.

Methods

This paper selects the Blackboard platform, whose framework is B / S / S structure, and its front end is the browser. The platform's server cluster includes Web servers, Blackboard application (written in Java and Perl language) and the background database server (oracle8i or MS -SQL-Server2000). It records the frequency of users visiting major course module, operations and the time of occurrence. Therefore, this study, on the basis of relevant documents, uses the relevant theory and data mining methods to analysis the BB background data, which includes the descriptive statistics and analysis of the user access pattern and training period. Secondly, by using the method of visualization analysis, this study presents the students' learning preferences, then analyzes the main learning frequency of students visiting major course module by using Hierarchical Clustering method to divide them into different categories, so that teachers can carry out individualized teaching according to the various features of the students. Finally, this study uses key words statistical methods to analyze the interaction with the teachers and students. Through the above five aspects, this study is going to describe the students' online learning behavior characteristics as to dig out the "virtual voice"

Analysis

(1) The overall access pattern of the platform module
Table 1 below shows the access pattern of the teachers and students when they are in the process of learning this course.

Table 1: Access platform module between teachers and students.

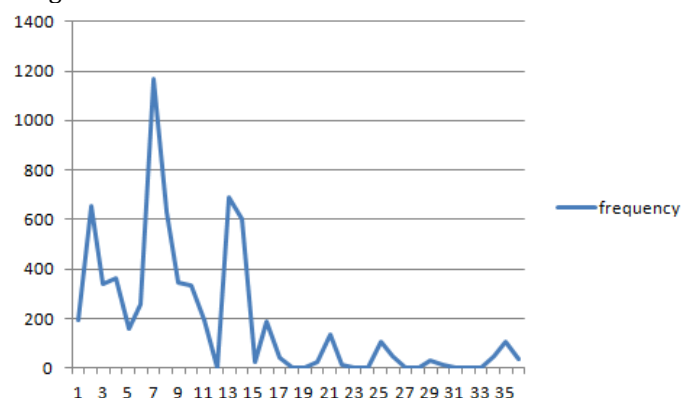| Area ID	Clicks	Percentage
Announcements	322	8.15%
Vocabulary	14	0.35%
Blog	17	0.43%
Collaborative	20	0.51%
Content options	2723	68.92%
Email	1	0.03%
Roster	1	0.03%
Tools	56	1.42%
Discussion board	395	10.00%
Group	295	7.47%
Grade	14	0.35%
Log	8	0.20%
Contacts	13	0.33%
My grades	33	0.84%
task	39	0.99%

The statistical result shows that the "Content options" is the most frequently accessed module. It shows that self-review and study after classes are the main learning activities. Secondly, the frequency discussion boards are 395 times, hence the number of discussions in the platform is still relatively small, mainly because of there are only a few of online supporting staff.

(2)Training time distribution statistics
According to the teaching program, the course of teaching time began from October 10 to November 11 in 2017, in a total of 7 weeks. However, statistics showed that the frequency of access module has been 194 times in October 7 (2017 and there are 15 times September 2), there were still 36 times until November 26, after that the frequency began to decline rapidly. Thus, we thought that the network curriculum teaching starting-time in advance can be guaranteed to October 7. Its end-time was slightly delayed and we can determine that the curriculum actually ended at

the November 11, in a duration of 36 days, which is shown in figure 1.

Figure 1: Statistics on frequency changeable access to student module by units of days.

We can see the frequency varies with time clearly, which is to rise quickly to reach a peak, and then decreased rapidly, then slow down after the sudden rise. There will be a little small fluctuation in a few days until the end. If we use "week" as a standard to count the module access frequency, the trend will be clearer as Figure 2. The scheduled four weeks teaching time is extended to five weeks, reflecting that it is a great flexible in the online teaching. The daily and weekly chart reflected the frequency characteristics and can be used to optimize support services. Namely at the peak of frequency that students participate in learning activities (three weeks), teachers should ensure adequate time for online tutoring and prolong counseling time and increase the intensity of counseling, at the same time they should focus on the understanding and application of some important knowledge points. With decreased activity level, teachers can correspondingly reduce counseling time, which can both optimize the teaching manpower and keep students' learning.
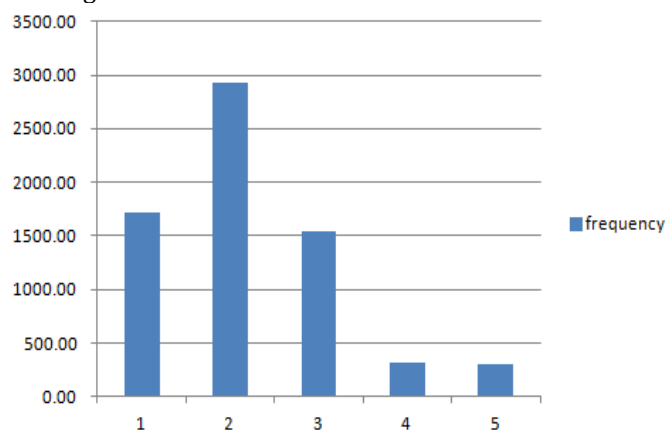
Figure 2: Statistics on frequency changeable access to student module by units of week.

In 36 days of teaching time, activities of teachers and student in the Blackboard platform were not consistent. It can be seen from Figure 1-3 more clearly, a few days before class, the frequency of teacher's activity were the highest, the frequency of student activities is the lowest, almost zero. The mainly reason is what the teacher should upload the electronic resources to the Blackboard platform, and make the corresponding classification in order to make students can use the learning resources after class. Subsequently, the frequency of teacher's activity is reduced in the Blackboard platform, and frequency of students' activities increased and peaked in the second week, there will appear a peak at the third week, and then slowly decline.
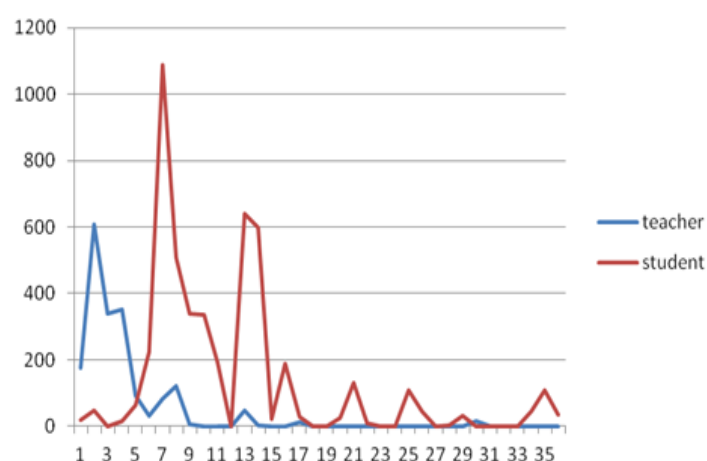
Figure 3: Comparison analysis of frequency access module between teachers and students.

Figure 3 shows that teacher log in Blackboard platform to work in the first five days. After that, the student began to visit the Blackboard platform. We can find that their behaviors are inconsistent. The frequency of students' accesses also showed a downward trend, which reflects the students' learning rely on information provided by the teacher. In addition, after investigation, we found that the interaction with teachers and students took place in the QQ, Wechat and other instant communication APP, which it can be told that the sustainability of the students' online learning and teacher's online tutoring case are related. If lack of online tutors, the learning autonomy and enthusiasm of students in the Blackboard platform will be affected. Therefore, college officials should not only strengthen the ability of teacher's online supporting and optimize the distribution of teachers to ensure enough online learning services to assist students, but also improve the utilization of Blackboard platform. This would help to create good atmosphere of using the platform and effectively raise the enthusiasm and persistence of students learning online. In addition, the school should constantly improve the interaction in Blackboard platform and make practical experience of convenience between teachers and students.

(3)Analysis on students' learning time preference
Analysis on students' learning time preference is mainly to know which day the students tend to study in a week and which time in a day. It can help teachers to choose counseling time more accurately by understanding this characteristic. At the same time, it also helps teachers to arrange other work time reasonably. The author classified and integrated the teaching stages and access frequency of students in the platform in a week, we get the following diagram (Table 2 and Figure 4):

**Table 2:** Students access frequency of each day in a week.

Week	Clicks	Percentage
Sunday	156	2.34%
Monday	1013	15.19%
Tuesday	2015	30.21%
Wednesday	961	14.41%
Thursday	1240	18.59%
Friday	727	10.90%
Saturday	559	8.38%
Total	6671	100%
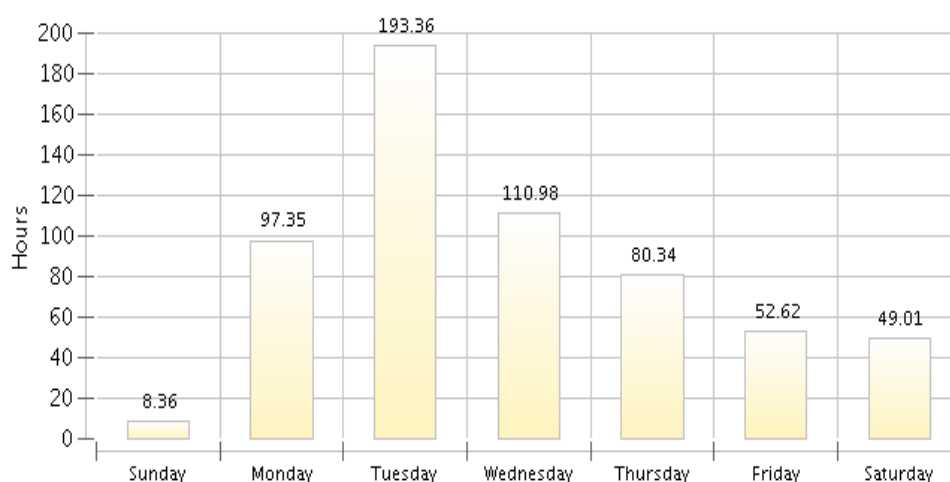
Figure 4: Students access frequency of hours of each day.

Above two chart (Table 2 and Figure 4) shows that the hours and access frequency variation are basically consistent in a week. The rush hour is from Monday to Thursday, with the highest peak in Tuesday, and the bottom on Sunday. The main reason is that the courses are mostly arranged to Sunday. According to the chart, although the students are on the job, their main learning hours are from Monday to Friday, with the highest peak appearing on Tuesday. Frequency statistics on that students click on the content module with time (for the unit is divided into morning, afternoon, evening and morning four sections), Figure 5.
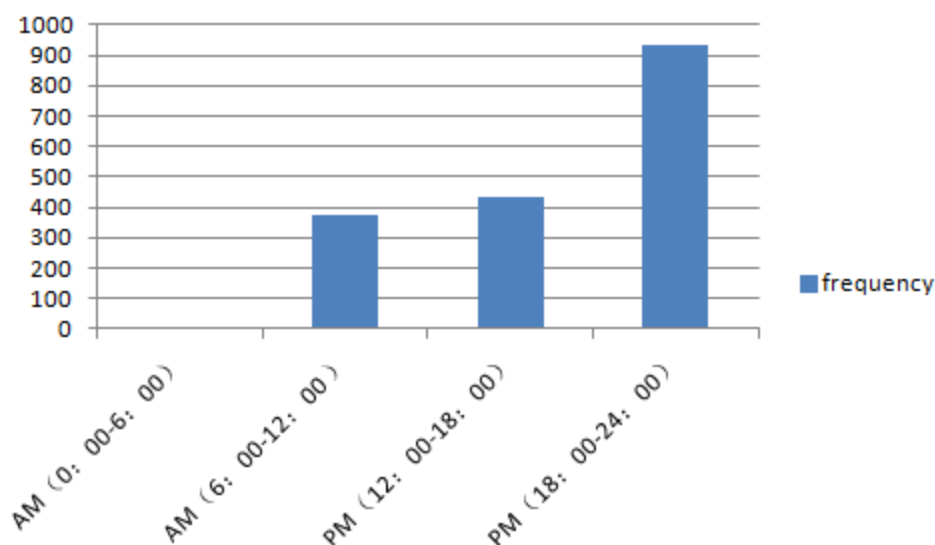
**Figure 5:** Frequency statistics on access module in every period time.

In general, students study the course at night by the Figure5. And the main reason is that most of the students have to work in the day. In addition, a small number of students visited the platform in the morning and afternoon. Maybe this time distribution would be different on weekdays and holidays. The author will make a further

analysis. Firstly, Monday to Sunday is represented respectively with "1, 2, 3, 4, 5, 6, 7"; A Day divided into the morning, afternoon, evening, respectively with "1, 2, 3,".

The double digits on the horizontal axis, ten digits represent week and single-digit represent period of time, such as "53" means that " Friday night".
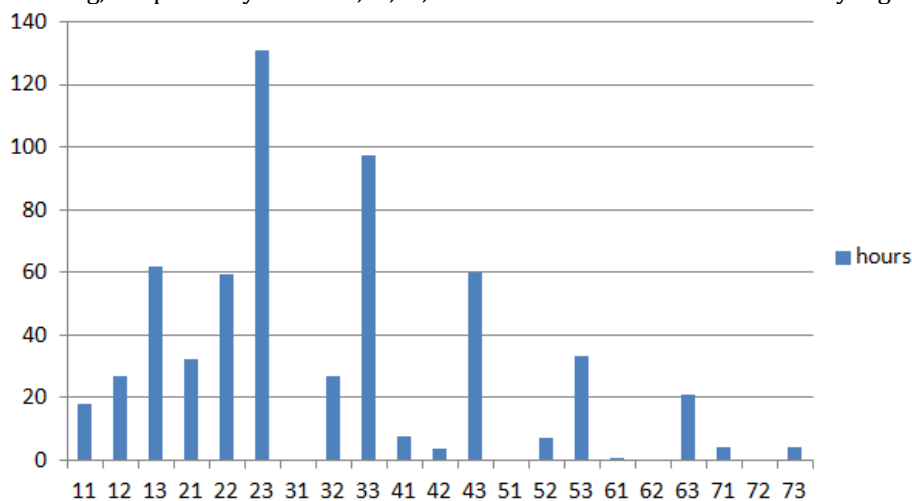
Figure 6: Frequency access module on each day of a week.

From the chart (Figure 6), Students learn mainly on Tuesday, Wednesday and Thursday nights. They spend more time for study on Tuesday nights rather than other days. Students concentrate on learning mostly from Monday to Thursday. Most of the students are part-time students in continuing education, so they do revision by using Blackboard platform on weekday nights after class. Since some of students are full-time or on shifts, so classes may be arranged on Monday and Tuesday morning or afternoon.

(4)Analysis of students' behavior by cluster method
According to statistics, content options, announcements, discussion groups and teams are in the top four of frequently accessed module. Among them, the frequency of content options is the highest, and it mainly consists of content courses, resources, assignments. Therefore, we will analysis the students' behavior by cluster method. Firstly, based on the frequency of the six modules, we put course, resources, assignments, announcements, discussion board, and groups as a cluster variable. Then we assume that it was divided into 2 to 5 types. After the testing, we found that dividing into five types were the best. The basic information of each category in the following table (Table 3).

Table 3: Clustering Results on Students.

Classification	Number of students	the Mean Frequency access Each Module					
		Course	Resources	Assignment	Announcement	Discussion Board	Group
The First	25	1.76	5.88	2.88	2.48	1.52	2.32
The Second	16	9.94	18.56	14.75	5.69	8.52	4.75
The Third	4	20	30	34.25	13.25	31	26
The Forth	3	27.33	33.67	61.00	12.67	22.67	5.67
The Fifth	1	16．00	64．00	35.00	15.00	2.00	1.00

We can find from the Table 3, the active degree of students gradually increased from Class 1 to Class 5, and mainly included of courses, resources and operations. Among them, the frequency of discussion boards and group were low due to the interaction with teachers and students usually happens on QQ, Wechat and other instant messaging software and it could lead to lower frequency of several modules. Through the clustering analysis of the students, it can be found that the most inactive is the first sort and there are 25 students. Tutors should quickly find their inactive reason and carry out targeted teaching method.

(5) Analysis interaction with teachers and students
In order to meet the immediacy and convenience demand in the interaction, the teacher choose QQ, Wechat and other instant messaging tools to make the communication with students. Through the analysis of the chat logs, we found that the first time of interaction was on September 16 and the last time appeared on November 20. Finally, we obtained 972 valid entries. Through the collation of data, we had counted the number of keywords which was "software, download files, having classes, curriculum content, examination, learning platform", as shown in Table 4.

Table 4: Analysis about interaction between teachers and students.

Key Word	Software	Download	Class	Curriculum Content	Examination	Learning Platform
Quantity	74	44	17	625	134	78

From the Table 4, we can conclude that the course content including specific subject, content, learning resources issues are the main interaction between teachers and students. It accounted for 64.3% of the chat logs. Second, the content such as the examination, learning platform and software installation are also the main content of the interaction, including practicing software installation, the use of the learning platform and course examination and professional related content. Although the majority of students are on the job, they still give special attention to the related content of learning and exam, in order to learn useful knowledge and pass the exam. Secondly, the key words 'Having class' appeared 17 times, it accounting for 1.7% of chats. This section is related to the time and place arrangements. And it reflects that the educational administration management, notification and other work should be improved.

In addition, the author statistics on teachers and students of chat logs. It showed that teacher's chat logs are accounted for 24.6% of all. And the most active five students accounted for 5.3%, 5.1%, 4.6%, 4.4% and 4.1% of total chat records respectively and rest accounted for about 1%. In general, the interaction of students is lower than the teacher. This suggests that the teacher is not only a "leader" role, but also actively coordinate communication with different students. Teachers function as the important "bridging" role. And in interactive software, the most active five students also played an intermediary role in the study.

Conclusion

This example uses the conventional statistical methods, visualization methods and Hierarchical Cluster methods to reveal the "invisible sound" in the learning process on network.

(1)On use of the Blackboard platform module, Content Option Module is the main place between teachers and students, including curriculum, resources and assignments. The discussion board and group visits are relatively small, because interaction mostly occurred on the instant messaging software, which is related to the convenience of using the platform and the teaching style of teachers'.

(2)On the teaching schedule, it is great flexibility for the online learning start-stop schedule. And the duration of online learning may be significantly different from teaching schedule. The end of the course does not mean the end of learning. the teacher should pay attention to the following teaching work after the end of the network course. Therefore, Online tutors should extend its teaching time reasonably so that students can get timely guidance in the Blackboard platform. Furthermore, in Virtual Voice, it is found that students' learning time is concentrated on the first half of the total learning time of the course, and the

frequency of activities in the later period of study is less, which reflects that the students' learning autonomy is not strong in continuing education. In the process, they use platform only to complete the learning task, and they are lack of motivation to explore other knowledge content. Therefore, in the implementation of network platform teaching, we should arrange a teacher who specializes in teaching on the network platform. The purpose of this approach is to enhance students' interest in learning on the platform, to guide them to correct autonomous learning and to monitor the students' learning behavior on the platform.

(3)In terms of student's learning time preference, since most of students are part-time study, leading them to concentrate their study time on weekday evenings and evenings. In the background data monitoring, it was found that they spend time on online learning mainly in the afternoon and evening from Monday to Thursday. The afternoon classes are mostly arranged on 5 PM to 6 PM, which is so-called the weekend class. Based on students learning preferences, professors and the online tutors should allocate more time to strengthen the interaction with the students and solve students' learning problem instantly, so as to achieve a good teaching effect.

(4)It mainly divided into five types in terms of student classification, among them there are 25 inactive students, which account for half of the class. According to the distribution of the number of students, the number of students with low activity accounted for 83.6% of the total number of students in the class. It can be seen that there is a lack of initiative of students in using the platform, among which the lack of proper guidance from teachers is one of the reasons for the low activity of students on the platform. It is found that resources and assignments are main places for students to be active, whether they are students with high activity or students with low activity. Tutors should strengthen intervention of inactive students and take appropriate measures to improve their willingness.

(5)In terms of interaction with teachers and students, Students are still focused on learning content , in which they are concerned about the examination content. This reflects that the main purpose of continuing education is to pass the exam. In addition, the school should improve the educational administration of continuing education students (the time of the having class and the location of the test, etc). Secondly, the teacher plays a main "leader" and "broker" in the process of interaction, but "opinion leader" of the students is rare. And the mind of students' self-study is not strong, so it need to take action to strengthen.

Statements

All the data in this paper are from the Blackboard platform of the "Computer Application Foundation" Course in the education institute of Jinan university. Before the study, the author has gained the permission of the college and the research subjects and their authorization to use the research data. As the data in Blackboard platform will be cleaned up once a semester, the author had downloaded the related packet. If you need the access to it, please send an email to the author. Once it is agreed by the author, you can get access to the raw data. However, it is noteworthy that interviewer who has right to access the data must promise not to make the data public, not to make use of it and not to change any data in the packet.

Researchers well recognize the privacy of the participants and respect their relevant rights. The private information of research subjects in the research is anonymous in this paper and there will be no real name and other details about the research subjects in this paper.

The authors promise that there is no potential conflicts of interest in the research content and related research work.

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